Viscosity of Brine Solutions with Carbon Dioxide

Mark McBride-Wright [S], Geoffrey C. Maitland and J. P. Martin Trusler [C]
Imperial College London, Qatar Carbonates and Carbon Storage Research Centre (QCCSRC), Department of Chemical Engineering, London, United Kingdom
m.trusler@imperial.ac.uk

Capture of carbon dioxide resulting from fossil fuel combustion, and its subsequent geological storage, is currently considered a favourable option for reducing emissions of this greenhouse gas. Deep saline aquifers represent a sink that can potentially store very large amounts of CO_2 on a geological timescale. Knowledge of the thermophysical properties of the fluids of interest, at reservoir conditions, is vital for characterising their behaviour in the subsurface, developing predictive models for use in reservoir simulators, and for monitoring post-injection. This research is focussed on determination of the viscosity of brines chosen to be representative of a typical saline aquifer, and the effect thereon of dissolved CO_2. For this purpose a vibrating-wire technique has been used for viscosity determination, with simultaneous measurements of density by means of a vibrating-tube densimeter. Wetted parts were made from Hastelloy-C276 and Pt-Ir alloy, chosen to resist corrosion. The viscosity of each brine studied in this work has been measured both at zero-saturation and with increasing amounts of dissolved CO_2 up to near saturation conditions. The measurements were made at temperatures from (298.15 to 448.15) K and at pressures up to 100 MPa in the single-phase compressed liquid region. The estimated overall uncertainty in viscosity and density are 2 % and 0.1 % respectively. Results are reported for pure water, for verification purposes, and in (water + CO_2) and several (brine + CO_2) systems. The results indicate a simple linear dependence of viscosity upon mole fraction of dissolved CO_2.

We gratefully acknowledge the funding of QCCSRC provided jointly by Qatar Petroleum, Shell, and the Qatar Science & Technology Park.